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National Eutrophication Survey, Corvallis, Oreg

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NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
LAKE MOULTRIE
BERKELEY COUNTY
SOUTH CAROLINA
EPA REGION IV
WORKING PAPER No. 435

WITH THE COOPERATION OF THE
SOUTH CAROLINA DEPARTMENT OF HEALTH AND
ENVIRONMENTAL CONTROL
AND THE
SOUTH CAROLINA NATIONAL GUARD

AUGUST, 1976

CONTENTS

	Page
Foreword	ii
List of South Carolina Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	4
III. Lake Water Quality Summary	5
IV. Nutrient Loadings	10
V. Literature Reviewed	16
VI. Appendices	17

F O R E W O R D

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the South Carolina Department of Health and Environmental Control for professional involvement, to the South Carolina National Guard for conducting the tributary sampling phase of the Survey, and to those South Carolina wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

The staff of the South Carolina Bureau of Wastewater and Stream Quality Control provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

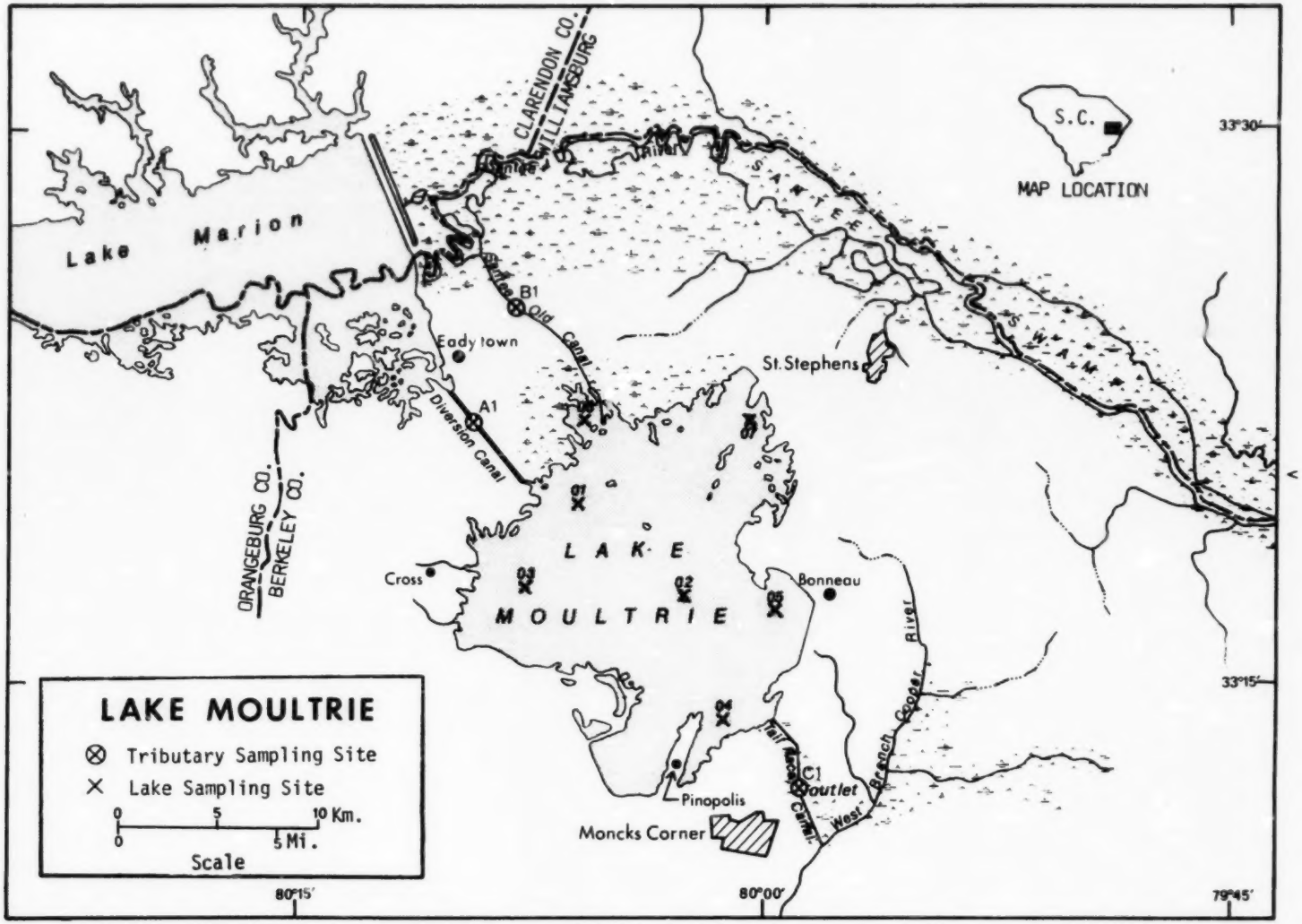
Major General Robert L. McCrady, the Adjutant General of South Carolina, and Project Officer Lt. Colonel John P. DuPre (Retired), who directed the volunteer efforts of the South Carolina National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF SOUTH CAROLINA

NAME	COUNTY
Clark Hill	Abbeville, McCormick, SC; Columbia, Elbert, Lincoln, McDuffie, Wilks, GA
Fishing Creek	Chester, Lancaster
Greenwood	Greenwood, Laurens, Newberry
Hartwell	Anderson, Oconee, Pickens, SC; Franklin, Hart, Stephens, GA
Keowee	Oconee, Pickens
Marion	Berkeley, Calhoun, Claredon, Orangeburg, Sumter
Moultrie	Berkeley
Murray	Lexington, Newberry, Richland, Saluda
Robinson	Chesterfield, Darlington
Saluda	Greenville, Pickens
Secession	Abbeville, Anderson
Wateree	Fairfield, Kershaw, Lancaster
William C. Bowen	Spartanburg
Wylie	York, SC; Gaston, Mecklenburg, NC


LAKE MOULTRIE
Tributary Sampling Site
Lake Sampling Site
0 5 10 Km.
0 5 Mi.
Scale
Lake Marion
CLARENDON CO.
WILLIAMSBURG CO.
ORANGEBURG CO.
BERKELEY CO.
Eadytown
St. Stephens
Cross
Bonneau
Pinopolis
Moncks Corner
Diversion Canal
Old Canal
Tail Race Canal
West Branch Cooper River
S.C.
MAP LOCATION
33°30'
33°15'
80°15'
80°00'
79°45'

LAKE MOULTRIE

STORET NO. 4512

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Lake Moultrie is eutrophic. It ranked fifth in overall trophic quality when the 13 South Carolina lakes sampled in 1973 were compared using a combination of six parameters*. Five of the lakes had less median total phosphorus, three had less and two had the same median dissolved orthophosphorus, two had less median inorganic nitrogen, 11 had less mean chlorophyll a, and three had greater mean Secchi disc transparency.

Survey limnologists did not observe any surface concentrations of algae but reported that aquatic macrophytes were common along most of the shoreline.

B. Rate-Limiting Nutrient:

The algal assay results indicate the lake was phosphorus limited at the time the samples were collected (03/26/73). The lake data indicate phosphorus limitation in July and September as well.

C. Nutrient Controllability:

1. Point sources--It is estimated that the phosphorus contributions of point sources accounted for 43.5% of the total load reaching Lake Moultrie during the sampling year. The indirect municipal point sources in the drainage of upstream Lake Marion**

* See Appendix A.
** Working Paper No. 434.

contributed almost all of the load. However, the phosphorus contributions of the distant municipal point sources in the Broad River drainage of Lake Marion were not included as point-source loads to that lake, so the proportion of indirect point-source phosphorus inputs to Lake Moultrie must be greater than indicated.

The phosphorus loading of 2.31 g/m^2 measured during the sampling year is 1.7 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 15). However, Vollenweider's model probably does not apply to water bodies with short hydraulic retention times, and the mean hydraulic retention time of Lake Moultrie is a relatively short 42 days. Nonetheless, the existing trophic condition of the lake is evidence of excessive nutrient loads.

It is calculated that 85% phosphorus removal at the indirect point sources considered in this report would reduce the loading to 1.46 $g/m^2/yr$, or a little more than the eutrophic loading. However, considering all of the point-sources in the Lake Marion drainage and the persistent phosphorus-limited condition of Lake Moultrie, it is likely that a high degree of point-source phosphorus control at the indirect sources would result in a significant improvement in the trophic condition of Lake Moultrie, although the numbers of rooted aquatic macrophytes might not be affected

because of the alternate source of nutrients in the lake sediments.

2. Non-point sources--Non-point phosphorus inputs, including precipitation, amounted to 56.5% of the total load. The Diversion Canal accounted for 53.9%, and the ungaged minor tributaries and immediate drainage contributed an estimated 1.8%.

During the Survey sampling year, about one-half of the area of Lake Moultrie was part of the Santee National Wildlife Refuge, a major Atlantic Flyway waterfowl wintering refuge. On the basis of information provided by the Refuge Manager (Strickland, 1976), the amounts of nutrients contributed to Lake Moultrie by migratory waterfowl were estimated (see page 11 for method of calculation).

Ducks using the refuge added an estimated 50 kg P and 165 kg N during the sampling year and accounted for less than 0.1% of the total phosphorus and total nitrogen loads.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 263.05 kilometers^2.
2. Mean depth: 5.7 meters.
3. Maximum depth: 23.0 meters.
4. Volume: 1,494.373 x 10^6 m^3.
5. Mean hydraulic retention time: 42 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Diversion Canal	38,073.0	409.390
Santee Old Canal	19.1	0.166
Minor tributaries & immediate drainage -	513.5	4.460
Totals	38,605.6	414.016

2. Outlet -

Tail Race Canal	38,850.0**	414.016**

C. Precipitation***:

1. Year of sampling: 120.0 centimeters.
2. Mean annual: 113.8 centimeters.

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† Table of metric conversions--Appendix B.
†† Martin and Hanson, 1966; maximum depth from Mast, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake; outflow adjusted to equal sum of inflows.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Lake Moultrie was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at seven stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, two 18.9-liter depth-integrated samples were composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 6.1 meters at station 1, 7.9 meters at station 2, 6.7 meters at station 3, 13.7 meters at station 4, 9.1 meters at station 5, 4.9 meters at station 6, and 2.4 meters at station 7. Station 6 was sampled only in March.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR LAKE MOULTRIE
STORET CODE 4512

PARAMETER	1ST SAMPLING (3/26/73) 7 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/ 9/73) 6 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/21/73) 6 SITES RANGE	MEAN	MEDIAN
TEMP (C)	15.0 - 15.7	15.4	15.5	28.3 - 31.6	29.7	29.5	27.4 - 28.3	27.8	27.7
DISS OXY (MG/L)	9.2 - 10.2	9.6	9.6	3.8 - 8.0	6.3	6.2	6.4 - 7.6	7.0	7.0
CNDCTVY (MCROMO)	68. - 85.	72.	70.	70. - 79.	72.	71.	78. - 85.	82.	82.
PH (STAND UNITS)	7.1 - 7.7	7.4	7.4	6.1 - 8.4	7.2	7.3	6.6 - 7.6	7.0	6.9
TOT ALK (MG/L)	10. - 19.	14.	15.	22. - 28.	25.	25.	12. - 21.	17.	17.
TOT P (MG/L)	0.042 - 0.059	0.050	0.049	0.018 - 0.036	0.025	0.025	0.016 - 0.020	0.018	0.018
ORTHO P (MG/L)	0.005 - 0.013	0.009	0.008	0.004 - 0.010	0.005	0.005	0.003 - 0.010	0.005	0.005
NO2+NO3 (MG/L)	0.190 - 0.320	0.230	0.230	0.050 - 0.170	0.101	0.095	0.020 - 0.050	0.031	0.030
AMMONIA (MG/L)	0.010 - 0.060	0.032	0.030	0.070 - 0.190	0.107	0.100	0.030 - 0.060	0.040	0.040
KJEL N (MG/L)	0.200 - 0.600	0.350	0.300	0.500 - 1.300	0.732	0.650	0.300 - 0.900	0.460	0.400
INORG N (MG/L)	0.230 - 0.380	0.263	0.255	0.130 - 0.320	0.209	0.190	0.050 - 0.110	0.071	0.070
TOTAL N (MG/L)	0.400 - 0.820	0.580	0.540	0.670 - 1.380	0.833	0.775	0.320 - 0.950	0.491	0.430
CHLRPYL A (UG/L)	7.7 - 12.6	10.1	10.3	6.6 - 8.8	7.6	7.4	6.8 - 10.1	8.4	8.1
SECCHI (METERS)	0.5 - 0.8	0.6	0.6	1.0 - 1.7	1.3	1.4	1.3 - 1.9	1.5	1.4

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/26/73	1. Flagellates	1,205
	2. *Cyclotella sp.*	829
	3. *Synedra sp.*	339
	4. *Stichococcus sp.*	282
	5. *Rhaphidiopsis sp.*	245
	Other genera	885
	Total	3,785
07/09/73	1. *Melosira sp.*	4,812
	2. *Lyngbya sp.*	3,609
	3. *Scenedesmus sp.*	740
	4. *Dactylococcopsis sp.*	555
	5. Flagellates	555
	Other genera	3,332
	Total	13,603
09/21/73	1. *Dactylococcopsis sp.*	7,280
	2. *Chroococcus sp.*	6,850
	3. *Melosira sp.*	1,540
	4. Pennate diatoms	770
	5. *Scenedesmus sp.*	630
	Other genera	630
	Total	17,700

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/26/73	1	9.0
	2	10.8
	3	11.2
	4	10.3
	5	9.4
	6	12.6
	7	7.7

Sampling Date	Station Number	Chlorophyll a (µg/l)
07/09/73	1	6.8
	2	7.3
	3	8.5
	4	7.5
	5	6.6
	6	-
	7	8.8
09/21/73	1	7.9
	2	7.7
	3	6.8
	4	10.1
	5	8.4
	6	-
	7	9.8

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. Stations 1, 2, 3, 4, and 6 -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.014	0.218	2.4
0.010 P	0.024	0.218	4.9
0.020 P	0.034	0.218	5.7
0.050 P	0.064	0.218	5.7
0.025 P + 0.5 N	0.039	0.718	15.4
0.050 P + 1.0 N	0.064	1.218	23.0
1.0 N	0.014	1.218	2.4

b. Stations 5 and 7 -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.016	0.226	3.0
0.010 P	0.026	0.226	5.7
0.020 P	0.036	0.226	6.9
0.050 P	0.066	0.226	7.0
0.025 P + 0.5 N	0.041	0.726	12.5
0.050 P + 1.0 N	0.066	1.226	21.0
1.0 N	0.016	1.226	3.6

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Lake Moultrie was moderately high at the time the samples were collected (03/26/73). Also, the increasing yields with increasing concentrations of orthophosphorus indicate that the lake was phosphorus limited at that time. Note that the addition of only nitrogen resulted in yields not significantly different from the control yields.

The lake data also indicate phosphorus limitation; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 16/1 or greater at all sampling times, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the South Carolina National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of January when two samples were collected. Sampling was begun in February, 1973, and was completed in February, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the South Carolina District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in kg/km^2/year, at stations C-1, F-1, J-1, and K-1 of nearby Lake Marion** and multiplying the means by the ZZ area in km^2.

Estimates of the nutrient contributions of migratory ducks are based on the following information provided by Refuge Manager Charles Strickland (1976): In 1973-74, duck-use-days totaled 1,152,500 (one-half of the ducks were mallards), and coot-use-days totaled 154,850.

In calculating the nutrient loads, the following assumptions were made:

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* See Working Paper No. 175.
** Working Paper No. 434.

1. Mallard ducks spend one-third of their time away from the refuge waters (i.e., effective mallard-use-days = 384,165).

2. The remaining ducks and the coots spend practically all of their time on the refuge waters and thus essentially recycle nutrients from the lake back to the lake.

3. The physiology of waste excretion is similar among waterfowl, and the amount of feces produced is approximately proportional to body weight (Hutchinson, 1950).

4. The mean weight of common Canada geese is 3.870 kg and that of mallard ducks is 1.148 kg (Kortright, 1943).

5. Common Canada geese contribute 0.439 g total phosphorus and 1.435 g total nitrogen per goose-use-day (Manny et al., 1975).

Only two small domestic point sources are located in the immediate Lake Moultrie drainage. Neither of these sources was sampled, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year. Note that the Cross High School population served was adjusted for normal school attendance.

The indirect municipal point-source loads leaving upstream Lake Marion were calculated by multiplying the nutrient loads leaving that lake via the Diversion Canal and Santee Old Canal (588,120 kg P and 8,824,855 kg N) by the fractions of the totals of the nutrient loads contributed by the point sources (0.449 for P and 0.234 for N). All of the loads calculated in this way were subtracted from the loads measured in the Diversion Canal at station A-1, since only a very small proportion reached Lake Moultrie through Santee Old Canal.

A. Waste Sources†:

1. Known domestic -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Cross High School	188*	stab. pond	71.2**	ditch/Lake Moultrie
Landopines SD, Pinopolis	50	stab. pond	15.1	Lake Moultrie

2. Known industrial - None

† Foley, 1976.
* Adjusted: 750 students for 8 hours per day, 5 days per week, 9 months per year.
** Estimated at 0.3785 m^3/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Diversion Canal	327,795	53.9
Santee Old Canal	260	<0.1
b. Minor tributaries & immediate drainage (non-point load) -	11,040	1.8
c. Known domestic STP's -		
Cross High School	190	<0.1
Landopines SD	55	<0.1
Indirect - Lake Marion drainage	264,065	43.4
d. Septic tanks* -	60	<0.1
e. Indirect industrial from Lake Marion drainage - Unknown	?	-
f. Migratory ducks	50	<0.1
g. Direct precipitation** -	4,605	0.7
Total	608,120	100.0

2. Outputs -

Lake outlet - Tail Race Canal 392,415

3. Net annual P accumulation - 215,705 kg.

* Estimate based on eight campgrounds and 93 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Diversion Canal	6,757,145	72.8
Santee Old Canal	2,695	<0.1
b. Minor tributaries & immediate drainage (non-point load) -	172,535	1.9
c. Known domestic STP's -		
Cross High School	640	<0.1
Landopines SD	170	<0.1
Indirect - Lake Marion drainage	2,065,015	22.2
d. Septic tanks* -	2,150	<0.1
e. Indirect industrial from Lake Marion drainage - Unknown	?	-
f. Migratory ducks -	165	<0.1
g. Direct precipitation** -	283,990	3.1
Total	9,284,505	100.0

2. Outputs -

Lake outlet - Tail Race Canal 10,270,315

3. Net annual N loss - 985,810 kg.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Diversion Canal	9	177
Santee Old Canal	14	141

* Estimate based on eight campgrounds and 93 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	2.31	0.82	35.3	loss*

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Lake Moultrie:	
"Dangerous" (eutrophic loading)	1.36
"Permissible" (oligotrophic loading)	0.68

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, unsampled point sources discharging directly to the lake, or underestimation of the nitrogen loads from septic tanks. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's former National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

V. LITERATURE REVIEWED

Foley, John R., 1976. Personal communication (permitted point sources in the Lake Moultrie drainage). SC Dept. of Health & Env. Contr., Columbia.

Hutchinson, George Evelyn, 1970. Biogeochemistry of vertebrate excretion. Bull. Amer. Mus. Nat. Hist. 96: 1-554.

Kortright, Francis H., 1943. The ducks, geese and swans of North America (2nd ed.). Amer. Wildlife Inst., Wash., DC.

Malueg, Kenneth W., D. Phillips Larsen, Donald W. Schults, and Howard T. Mercier; 1975. A six-year water, phosphorus, and nitrogen budget for Shagawa Lake, Minnesota. Jour. Environ. Qual., vol. 4, no. 2, pp. 236-242.

Manny, B. A., R. G. Wetzel, and W. D. Johnson, 1975. Annual contribution of carbon, nitrogen and phosphorus by migrant Canada geese to a hardwater lake. Verh. Int. Ver. Linnol. 19: 949-951.

Martin, R. O. R., and Ronald L. Hanson; 1966. Reservoirs in the United States. Water Supply Paper 1838, U.S. Geol. Surv., Wash., DC.

Mast, G. Nelson, 1974. Personal communication (maximum depth). SC Dept. of Health & Env. Contr., Columbia.

Strickland, Charles (Manager), 1976. Personal communication (waterfowl-use-days - lakes Marion and Moultrie). Santee Natl. Wildlife Refuge, Summerton.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
4503	FISHING CREEK RESERVOIR	0.143	0.535	483.000	2.811	10.200	0.051
4504	LAKE GREENWOOD	0.061	0.470	463.917	8.150	15.000	0.011
4505	LAKE HARTWELL	0.013	0.130	422.000	6.157	15.000	0.004
4506	LAKE MARION	0.055	0.280	470.176	8.728	14.900	0.010
4507	LAKE MURRAY	0.024	0.260	424.905	6.478	15.000	0.007
4508	LAKE ROBINSON	0.014	0.260	458.778	8.611	14.000	0.005
4510	LAKE WATEREE	0.094	0.450	475.667	8.408	14.100	0.034
4511	LAKE WYLIE	0.045	0.380	462.222	5.422	14.800	0.013
4512	LAKE MOULTRIE	0.026	0.200	455.36	8.800	11.200	0.006
4513	LAKE KEOWEE	0.008	0.170	371.750	2.833	15.000	0.003
4514	LAKE SECESSION	0.057	0.355	462.778	10.722	15.000	0.006
4515	SALUDA LAKE	0.046	0.230	476.833	1.517	10.800	0.006
4516	LAKE WILLIAM C. BOWEN	0.022	0.360	459.889	3.911	15.000	0.007

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
4503	FISHING CREEK RESERVOIR	0 (0)	0 (0)	0 (0)	92 (11)	100 (12)	0 (0)	192
4504	LAKE GREENWOOD	17 (2)	8 (1)	33 (4)	42 (5)	21 (0)	25 (3)	146
4505	LAKE HARTWELL	92 (11)	100 (12)	92 (11)	58 (7)	21 (0)	92 (11)	455
4506	LAKE MARION	33 (4)	50 (6)	25 (3)	17 (2)	50 (6)	33 (4)	208
4507	LAKE MURRAY	67 (8)	62 (7)	83 (10)	50 (6)	21 (0)	46 (5)	329
4508	LAKE ROBINSON	83 (10)	62 (7)	67 (8)	25 (3)	75 (9)	83 (10)	395
4510	LAKE WATEREE	8 (1)	17 (2)	17 (2)	33 (4)	67 (8)	8 (1)	150
4511	LAKE WYLIE	50 (6)	25 (3)	50 (6)	67 (8)	58 (7)	17 (2)	267
4512	LAKE MOULTRIE	58 (7)	83 (10)	75 (9)	8 (1)	83 (10)	71 (8)	378
4513	LAKE KEOWEE	100 (12)	92 (11)	100 (12)	83 (10)	21 (0)	100 (12)	496
4514	LAKE SECESSION	25 (3)	42 (5)	42 (5)	0 (0)	21 (0)	58 (7)	188
4515	SALUDA LAKE	42 (5)	75 (9)	8 (1)	100 (12)	92 (11)	71 (8)	388
4516	LAKE WILLIAM C. BOWEN	75 (9)	33 (4)	58 (7)	75 (9)	21 (0)	46 (5)	308

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4513	LAKE KEOWEE	496
2	4505	LAKE HARTWELL	455
3	4508	LAKE ROBINSON	395
4	4515	SALUDA LAKE	388
5	4512	LAKE MOULTRIE	378
6	4507	LAKE MURRAY	329
7	4516	LAKE WILLIAM C. BOWEN	308
8	4511	LAKE WYLIE	267
9	4506	LAKE MARION	208
10	4503	FISHING CREEK RESERVOIR	192
11	4514	LAKE SECESSION	188
12	4510	LAKE MATEREE	150
13	4504	LAKE GREENWOOD	146

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4512 LAKE MOULTRIE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 38850.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4512A1	38073.0	485.88	542.38	576.27	519.78	412.43	361.58	333.33	341.81	316.38	310.73	338.98	382.77	409.39
4512B1	14.1	0.198	0.340	0.396	0.255	0.142	0.085	0.113	0.085	0.085	0.085	0.113	0.113	0.166
4512C1	38850.0	502.27	389.40	344.25	327.32	347.07	335.78	327.32	349.89	403.51	499.44	555.88	598.20	415.34
4512ZZ	512.8	5.32	8.83	10.51	6.74	3.88	2.63	2.86	2.58	2.04	2.46	2.80	3.17	4.46

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 38850.0
SUM OF SUB-DRAINAGE AREAS = 38604.9
TOTAL FLOW IN = 4978.11
TOTAL FLOW OUT = 4980.33

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4512A1	2	73	775.882	25	739.070				
	3	73	741.901	20	645.624				
	4	73	764.555	15	838.178				
	5	73	492.713	20	421.921				
	6	73	807.030	10	993.921				
	7	73	498.376	10	495.545				
	8	73	407.762	12	515.366				
	9	73	419.089	10	345.465				
	10	73	232.198	12	220.871				
	11	73	202.182	11	216.907				
	12	73	396.436	10	356.792				
	1	74	736.238	13	742.872	27	705.089		
	2	74	756.060	17	651.287				
4512B1	2	73	1.133	25	0.255				
	3	73	1.048	20	0.425				
	4	73	1.671	15	0.850				
	5	73	0.057	20	0.028				
	6	73	0.680	10	0.198				
	7	73	0.057	10	0.057				
	8	73	0.028	12	0.028				
	9	73	0.028	10	0.028				
	10	73	0.028	12	0.028				
	11	73	0.028	11	0.028				
	12	73	0.142	10	0.057				
	1	74	0.340	13	0.057	27	0.085		
	2	74	0.708	17	1.557				

TRIBUTARY FLOW INFORMATION FOR SOUTH CAROLINA 04/27/76

LAKE CODE 4512 LAKE MOULTRIE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4512C1	2	73	792.872	25	741.901				
	3	73	775.882	20	824.020				
	4	73	790.040	15	807.030				
	5	73	526.693	20	178.679				
	6	73	801.367	10	824.020				
	7	73	484.218	10	546.515				
	8	73	421.921	12	574.832				
	9	73	387.941	10	176.697				
	10	73	245.507	12	339.802				
	11	73	220.305	11	189.723				
	12	73	489.315	10	470.060				
	1	74	656.951	13	693.763	27	671.109		
	2	74	719.248	17	719.248				
4512Z2	2	73	30.865	25	6.654				
	3	73	28.034	20	11.327				
	4	73	42.475	15	22.087				
	5	73	1.133	20	0.566				
	6	73	18.406	10	5.040				
	7	73	1.274	10	0.850				
	8	73	0.850	12	0.283				
	9	73	0.283	10	0.425				
	10	73	0.425	12	0.566				
	11	73	0.566	11	0.708				
	12	73	2.265	10	0.991				
	1	74	11.327	13	1.416	27	2.265		
	2	74	18.972	17	42.475				

25

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/04/27

451201
33 20 00.0 080 05 05.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030892

11EPALES 2111202
0023 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	11 20	0000	15.6		25	75	7.10	17	0.040	0.500	0.250	0.013
	11 20	0003	15.7	9.3		75	7.20	19	0.040	0.300	0.240	0.010
	11 20	0015	15.6	9.2		75	7.20	19	0.050	0.300	0.240	0.010
73/07/09	13 10	0000	31.1		40	78	8.30	24	0.120	1.000	0.060	0.006
	13 10	0005	30.0	7.6		70	7.40	23	0.110	0.700	0.080	0.005
	13 10	0009	29.9	7.6		70	7.40	24	0.090	0.600	0.110	0.005
	13 10	0015	29.3	6.2		72	6.90	24	0.150	0.600	0.170	0.005
	13 10	0020	29.1	5.6		71	6.90	25	0.120	0.500	0.170	0.005
73/09/21	10 35	0000	27.8		56	83	7.40	20	0.060	0.900	0.050	0.006
	10 35	0005	27.7	7.2		82	6.60	20	0.040	0.500	0.040	0.005
	10 35	0015	27.6	7.2		82	6.70	21	0.040	0.400	0.050	0.005

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	11 20	0000	0.057	9.0
	11 20	0003	0.057	
	11 20	0015	0.059	
73/07/09	13 10	0000	0.029	6.8
	13 10	0005	0.028	
	13 10	0009	0.024	
	13 10	0015	0.025	
	13 10	0020	0.027	
73/09/21	10 35	0000	0.019	7.9
	10 35	0005	0.018	
	10 35	0015	0.019	

STORET RETRIEVAL DATE 76/04/27

451202
33 17 10.0 080 01 45.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030892

11EPALES 2111202
0028 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	11 55	0000	15.6		27	70	7.20	17	0.050	0.400	0.240	0.009
	11 55	0004	15.6	9.6		70	7.30	15	0.020	0.300	0.240	0.008
	11 55	0015	15.3	9.6		70	7.30	14	0.020	0.300	0.240	0.008
	11 55	0025	15.0	9.8		70	7.30	13	0.020	0.300	0.260	0.011
73/07/09	15 50	0000	31.0		60	79	8.00	26	0.110	1.300	0.080	0.009
	15 50	0004	29.9	8.0		70	7.60	26	0.080	0.700	0.080	0.005
	15 50	0015	29.5	6.6		70	6.90	24	0.080	0.600	0.120	0.004
	15 50	0026	29.0	4.8		75	6.90	25	0.140	0.600	0.140	0.005
73/09/21	11 45	0000	28.1		58	83	7.00	17	0.040	0.700	0.040	0.005
	11 45	0005	27.7	7.4		84	6.90	18	0.030	0.400	0.030	0.005
	11 45	0015	27.6	7.0		82	6.70	19	0.040	0.300	0.030	0.005
	11 45	0022	27.6	6.8		82	6.80	19	0.050	0.400	0.030	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	11 55	0000	0.058	10.8
	11 55	0004	0.051	
	11 55	0015	0.049	
	11 55	0025	0.054	
73/07/09	15 50	0000	0.031	7.3
	15 50	0004	0.026	
	15 50	0015	0.026	
	15 50	0026	0.036	
73/09/21	11 45	0000	0.019	7.7
	11 45	0005	0.018	
	11 45	0015	0.018	
	11 45	0022	0.020	

STORET RETRIEVAL DATE 76/04/27

451203
33 17 37.0 080 07 58.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030892

11EPALES 2111202
0023 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	12 30	0000	15.5		24	73	7.50	15	0.020	0.500	0.250	0.010
	12 30	0003	15.6	9.8		73	7.40	15	0.010	0.500	0.240	0.008
	12 30	0015	15.5	9.6		70	7.40	15	0.020	0.200	0.250	0.009
	12 30	0022	15.4	9.8		70	7.40	17	0.030	0.200	0.240	0.009
73/07/09	16 50	0000	30.9		48	72	8.40	25	0.090	0.900	0.100	0.007
	16 50	0010	30.0	7.4		72	7.30	27	0.070	0.700	0.090	0.006
	16 50	0015	29.2	6.2		72	6.90	26	0.090	0.600	0.140	0.005
	16 50	0020	29.1	5.6		73	6.90	25	0.110	0.700	0.140	0.005
73/09/21	11 00	0000	28.1		52	84	7.40	20	0.050	0.700	0.030	0.006
	11 00	0005	27.7	7.2		85	6.90	18	0.040	0.600	0.050	0.010
	11 00	0013	27.4	6.4		82	6.80	16	0.050	0.400	0.050	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	12 30	0000	0.054	11.2
	12 30	0003	0.053	
	12 30	0015	0.054	
	12 30	0022	0.058	
73/07/09	16 50	0000	0.030	8.5
	16 50	0010	0.023	
	16 50	0015	0.024	
	16 50	0020	0.029	
73/09/21	11 00	0000	0.020	6.8
	11 00	0005	0.020	
	11 00	0013	0.020	

STORET RETRIEVAL DATE 76/04/27

451204
33 14 40.0 080 00 57.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030891

11EPALES 2111202
0048 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	13 00	0000	15.4		22	70	7.40	16	0.030	0.500	0.220	0.008
	13 00	0005	15.4	9.6		70	7.40	16	0.030	0.300	0.210	0.007
	13 00	0015	15.3	9.6		68	7.40	15	0.020	0.300	0.220	0.007
	13 00	0025	15.3	10.2		68	7.40	15	0.020	0.300	0.210	0.006
73/07/09	11 15	0000	29.9		68	75	7.60	25	0.090	1.200	0.080	0.009
	11 15	0005	29.4	7.8		70	7.40	24	0.070	0.600	0.070	0.004
	11 15	0025	28.8	5.4		71	6.20	24	0.160	0.600	0.100	0.004
	11 15	0045	28.3	3.8		71	6.10	24	0.190	0.800	0.110	0.006
73/09/21	11 25	0000	28.3		73	78	7.60	15	0.040	0.400	0.020	0.005
	11 25	0005	27.9	7.4		81	7.00	17	0.030	0.400	0.020	0.004
	11 25	0015	27.8	7.0		79	6.90	17	0.030	0.400	0.020	0.007
	11 25	0025	27.7	6.8		78	6.80	17	0.040	0.400	0.030	0.005

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	13 00	0000	0.049	10.3
	13 00	0005	0.047	
	13 00	0015	0.045	
	13 00	0025	0.043	
73/07/09	11 15	0000	0.028	7.5
	11 15	0005	0.021	
	11 15	0025	0.019	
	11 15	0045	0.028	
73/09/21	11 25	0000	0.017	10.1
	11 25	0005	0.016	
	11 25	0015	0.016	
	11 25	0025	0.017	

STORET RETRIEVAL DATE 76/04/27

451205
33 17 42.0 079 59 22.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030891

11EPALES 2111202
0031 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/26	15	0000	15.5		20	70	7.50	12	0.040	0.400	0.210	0.007
	15	0004	15.5	9.5		70	7.50	12	0.030	0.200	0.200	0.007
	15	0015	15.5	9.3		70	7.50	12	0.030	0.200	0.210	0.008
	15	0029	15.2	9.3		70	7.50	12	0.040	0.300	0.210	0.008
73/07/09	12	0000	29.8		40	71	7.90	26	0.080	0.900	0.050	0.004
	12	0005	29.5	7.6		71	7.40	22	0.110	0.600	0.070	0.010
	12	0020	29.3	5.8		71	7.00	28	0.090	0.700	0.080	0.010
	12	0030	28.8	4.7		72	6.80	27	0.140	0.600	0.110	0.004
73/09/21	12	0000	27.9		69	79	7.00	17	0.040	0.400	0.020	0.004
	12	0005	27.8	7.0		80	6.80	15	0.040	0.400	0.020	0.004
	12	0015	27.7	6.8		82	6.70	15	0.040	0.300	0.020	0.005
	12	0025	27.7	6.8		81	6.90	15	0.040	0.400	0.030	0.005

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/26	15	0000	0.044	9.4
	15	0004	0.044	
	15	0015	0.047	
	15	0029	0.049	
73/07/09	12	0000	0.022	6.6
	12	0005	0.019	
	12	0020	0.018	
	12	0030	0.021	
73/09/21	12	0000	0.016	8.4
	12	0005	0.017	
	12	0015	0.017	
	12	0025	0.018	

STORET RETRIEVAL DATE 76/04/27

451206
33 22 40.0 080 04 50.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030892

11EPALES 2111202
0020 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	09 00	0000	15.0		30	77	7.60	12	0.060	0.500	0.320	0.010
	09 00	0004	15.1	9.7		72	7.70	12	0.030	0.300	0.220	0.006
	09 00	0016	15.0	9.4		72	7.70	12	0.040	0.300	0.220	0.006

132

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	09 00	0000	0.046	12.6
	09 00	0004	0.046	
	09 00	0016	0.053	

STORET RETRIEVAL DATE 76/04/27

451207
33 22 42.0 079 59 55.0 3
LAKE MOULTRIE
45015 SOUTH CAROLINA
030891

11EPALES 2111202
0009 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/03/27	09 30	0000	15.6		24	85	7.70	10	0.050	0.600	0.200	0.008
	09 30	0005	15.5	9.6		72	7.60	10	0.040	0.400	0.190	0.005
73/07/09	16 25	0000	31.6		60							
	16 25	0008	30.0	6.6		70	7.30	26	0.070	0.600	0.080	0.004
73/09/21	15 05	0000	27.8		52	83	7.40	14	0.040	0.400	0.020	0.004
	15 05	0005	27.6	7.6		83	6.90	12	0.030	0.400	0.020	0.004

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/03/27	09 30	0000	0.046	7.7
	09 30	0005	0.042	
73/07/09	16 25	0000		8.8
	16 25	0008	0.023	
73/09/21	15 05	0000	0.018	9.8
	15 05	0005	0.018	

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/04/27

451241
33 23 00.0 080 08 00.0 4
DIVERSION CANAL
45 BERKELEY CO HWY
1/LAKE MOULTRIE 030892
ST HWY 45 BRDG
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	11 30		0.250	0.340	0.030	0.021	0.060
73/03/20	16 55		0.240	0.480	0.019	0.014	0.055
73/04/15	10 10		0.210	0.390	0.026	0.027	0.070
73/05/20	10 00		0.054	0.980	0.058	0.005K	0.030
73/06/10	11 45		0.066	1.600	0.410	0.009	0.030
73/07/10	12 15		0.093	0.200	0.039	0.007	0.035
73/08/12	11 25		0.050	0.460	0.044	0.019	0.027
73/09/10	15 10		0.036	0.440	0.025	0.005K	0.025
73/10/12	15 00		0.140	0.460	0.042	0.006	0.035
73/11/11	10 35		0.060	0.300	0.008	0.008	0.020
73/12/10	12 35		0.020	0.200	0.016	0.005K	0.030
74/01/13	11 20		0.320	0.500	0.052	0.024	0.060
74/01/27	12 00		0.276	0.200	0.028	0.016	0.040
74/02/17	11 05		0.270	0.400	0.029	0.015	0.055

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

451281
33 26 00.0 080 07 00.0 4
OLD CANAL
45 BERKELEY CO HWY
T/LAKE MOULTRIE 030892
ST HWY 45 BRDG 2 MI E OF LADYTOWN
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	11 45		0.010K	0.150	0.042	0.006	0.015
73/03/20	17 05		0.010K	0.690	0.030	0.015	0.035
73/04/15	10 20		0.010K	0.150	0.010	0.008	0.020
73/05/20	10 15		0.010K	0.130	0.010	0.012	0.030
73/06/10	12 05		0.019	1.300	0.270	0.028	0.080
73/07/10	12 30		0.010K	0.460	0.030	0.015	0.065
73/08/12	10 35		0.010K	1.050	0.046	0.024	0.055
73/09/10	15 20		0.010K	0.580	0.005K	0.005K	0.090
73/10/12	15 10		0.025	0.560	0.036	0.015	0.065
73/11/11	10 50		0.012	0.900	0.016	0.016	
73/12/10	12 50		0.010K	0.200	0.012	0.020	0.050
74/01/13	10 30		0.024	0.300	0.020	0.020	0.082
74/01/27	10 35		0.016	0.200	0.016	0.016	0.030
74/02/17	11 20		0.032	0.300	0.050	0.005	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/04/27

4512C1
33 13 00.0 079 58 30.0 4
TAIL RACE CANAL
45 BERKELEY CO HWY
T/LAKE MOULTRIE 030691
US HWY 52 BRDG 2 MI NE OF MONCKS CORNER
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/02/25	10 15		0.240	0.310	0.067	0.018	0.055
73/03/20	15 00		0.190	0.370	0.027	0.010	0.045
73/04/15	09 00		0.230	0.290	0.017	0.012	0.045
73/05/20	08 30		0.072	0.960	0.100	0.005K	0.030
73/06/10	10 30		0.030	1.600	0.110	0.008	0.030
73/07/10	11 05		0.034	0.580	0.060	0.006	0.030
73/08/12	09 20		0.010K	0.860	0.075	0.011	0.020
73/09/10	14 00		0.012	0.345	0.037	0.017	0.020
73/10/12	14 00		0.032	3.100	0.110	0.005K	0.030
73/11/11	09 20		0.010K	0.300	0.008	0.012	0.015
73/12/10	11 30		0.010K	0.200	0.016	0.008	0.020
74/01/13	09 00		0.084	0.300	0.020	0.005K	0.030
74/01/27	10 20		0.208	0.200	0.032	0.008	0.025
74/02/17	10 00		0.208	0.300	0.030	0.005K	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED